Humanities need a replication drive too

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published in
Nature
2018

DOI (link to publisher)
10.1038/d41586-018-05454-w

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Risks of tech metals under surveillance

Our understanding of the possible environmental and ecological toxic effects of technology-critical elements after extraction is not as limited as Winfred Espejo and colleagues imply (*Nature* **557**, 492; 2018). Research is being done into possible risks, especially in Europe, and the community of scientists involved is growing.

For instance, a European Cooperation in Science & Technology (COST) Action has been evaluating these risks since 2015. As well as organizing training schools and advanced workshops, the TD1407 action facilitates network and capacity building (see www.costnotice.net).

Many technology-critical elements have not been investigated (M. Filella and J. C. Rodríguez-Murillo *et al. Chemosphere* **182**, 605–616; 2017), but some have attracted attention. An example is gadolinium, mainly because of its rapid accumulation in surface waters. Several others cited by the correspondents have long been under investigation because they have applications that pre-date their current use in technology. Platinum is one such example.

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Replication drive for humanities

Research in humanities disciplines such as anthropology, archaeology, linguistics and theology can learn from replication failures in the biomedical and social sciences (go.nature.com/2stme7r).

Replication studies are not unprecedented in the humanities. The deciphering of Egyptian hieroglyphics was validated by comparing the Demotic, hieroglyphic and ancient Greek texts on the Rosetta stone found in 1799, for example. In 2013, the painting *Sunset at Montmajour* was confirmed as a genuine work by Vincent van Gogh after consulting letters by the artist describing it, and after analysing its chemical composition, colours and themes.

Replicability testing is particularly important for results in humanities disciplines that use empirical methods, and for cornerstone studies. Existing data sets can be reanalysed, or new data can be collected using the same or a modified study protocol (direct or conceptual replication, respectively). Conceptual replication is useful because it allows researchers to triangulate results.

Such testing will depend on preregistration of studies and on providing public access to detailed methods, data-analysis plans and data sets. It is also important to develop and use reporting guidelines for study protocols, publications and data sets. Funding agencies and scientific journals can help by demanding transparency and by funding and publishing replication studies.

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Use persistent identifiers more

Increasingly, ORCID, DOIs and other identifier systems that are open and community-governed are embedded in scholarly works and information systems, such as papers and citation indices. They could benefit research in many more ways than their current use in unambiguously tracking authors and published output.

Take, for example, the manuscript-submission process. Authors must create a journal account, review submission requirements and upload their manuscript, which probably contains links to other important information. Journals need to find unconflicted reviewers. Payment contacts for open access might be required. By using persistent identifiers, most of the manual processes in this workflow can be semi-automated (see go.nature.com/2lnqibu). Expertise should not be wasted on mundane administrative tasks.

Identifiers can also act as signposts and coordinates, guiding us to information sources and showing connections between research and researchers. They can increase the visibility of a study, its origins and its impact, and indicate where it is hosted and who to ask for access. Contributors, peer reviewers and supporting materials can all be linked to the published article.

An important feature of identifiers is that they afford a wider understanding of the research landscape that does not compromise privacy or 'ownership' of the research itself — pertinent, for example, when the work is ongoing, personal or competitive.

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PHILIPPE BORSA/IRD

Red-footed boobies (*Sula sula*) nesting in the Chesterfield archipelago.

Keep cruises off remote coral reefs

Just 3% of the world's coral reefs remain in near-pristine condition; about one-third of these are located in the Coral Sea in the South Pacific Ocean. The Chesterfield reef ensemble, one of the world's largest atolls, is an example. It is part of France's overseas territory of New Caledonia, and its remoteness has so far preserved its wealth of biodiversity. We therefore call for the territory's government to drop its plans to open these precious reefs to the destructive effects of cruise ships and mass ecotourism.

The Chesterfield reefs were spared the 2016 mass-bleaching phenomenon that affected coral reefs around the world. They host the largest seabird colonies in the tropical western Pacific. Indeed, nitrogen from seabird guano may contribute to the resilience of reef-building corals (A. Lorrain *et al. Sci. Rep.* **7**, 3721; 2017).

Comprising a remarkable variety of corals, the reefs host an abundance of diverse fish shoals and species such as the threatened fairy tern (*Sternula nereis*), several endemic marine gastropods and an endemic sea snake (*Hydrophis laboutei*). They are also a nesting site of regional importance for the green sea turtle (*Chelonia mydas*).

Cruise ships will inevitably disrupt the reef and lagoon habitats and fauna. Their hundreds of passengers will lethally disturb breeding seabird colonies, by repeatedly scaring away nesting adults. This could particularly affect the brown booby (*Sula leucogaster*), the lesser and greater frigatebirds (*Fregata ariel* and *F. minor*) and the sooty tern (*Onychoprion fuscatus*).

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